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# *Indian Standard*

# SPECIFICATION FOR CASTORS FOR HOSPITAL EQUIPMENT

## *( First Revision )*

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**BUREAU OF INDIAN STANDARDS**
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

**Gr 5** *January* 1980

# Indian Standard

# SPECIFICATION FOR CASTORS FOR HOSPITAL EQUIPMENT

## ( First Revision )

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( *Continued on page* 2 )

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# *Indian Standard*

# SPECIFICATION FOR CASTORS FOR HOSPITAL EQUIPMENT

## *( First Revision )*

## 0. FOREWORD

**0.1** This Indian Standard ( First Revision ) was adopted by the Indian Standards Institution on 30 April 1979, after the draft finalized by the Hospital Equipment Sectional Committee had been approved by the Consumer Products Division Council.

**0.2** The formulation of Indian Standards on hospital equipment has been taken up at the instance of the Advisory Committee for Development of Surgical Instruments Equipment and Appliances, Government of India.

**0.3** This revised standard has been prepared in the light of the comments received from the industry and the Controllerate of Inspection General Stores ( CIGS ). The main change is in the dimension of the axle which has now been related with the outside face of the nut.

**0.4** The castors specified in this standard are for use on hospital equipment. They may also be used on any other equipment for which they are found suitable.

**0.5** In addition to rubber treads, the castor wheels in rubber, nylon or polymer may also be used.

**0.6** Only essential dimensions have been specified to ensure interchangeability and to keep the spares to the minimum. The general design details and other features have been left to the manufacturers so as not to restrict the development of new designs.

**0.7** The castors may be made fixed-type also, if required by the purchaser. Other special features for specific use, for example, non-clogging type, locking, etc, may be provided at the option of the purchaser.

**0.8** In preparing this standard, considerable assistance has been derived from the following:

IND/GS/MED 264 (C) Castor, for assorted aseptic furniture. Chief Inspectorate of General Stores, Ministry of Defence, Government of India.

PN/Z/78045-1957 Kolka orumione-type lekki. Polski Komitet Normalizacyjny ( Hospital furniture, castors, light type. Polish Standards Committee ).

BS 2050 : 1961 Electrical resistance of conductive and anti-static products made from flexible polymeric material. British Standards Institution.

BS 2099 : Part I : 1970 Castors for hospital equipment. British Standards Institution.

CS 223-59 Castors, wheels and glides for hospital equipment, Commercial Standard, USA.

**0.9** For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

## 1. SCOPE

**1.1** This standard lays down requirements for swivel type castors for use on hospital equipment.

## 2. TERMINOLOGY

**2.0** For the purpose of this standard, the following terms and definitions shall apply ( *see* Fig. 1 ).

**2.1 Castor** — An assembly including a wheel fitted by means of an axle between the two flanges of an offset fork which can swivel freely around a geometrical vertical axis, with or without bushings or bearings, plain or otherwise. The swivel axle is fitted on a mounting part which can be a top plate or a stem.

**2.2 Overall Height or Effective Height** — The vertical distance between the bottom of the castor wheel and the surface on which the equipment normally rests, which is also equal to the vertical distance of the floor surface and the equipment.

**2.3 Fork** — A part with two flanges through which goes the axle and between which revolves the wheel.

**2.4 King Pin** — A means for effectively maintaining the alignment of swivel bearings parts.

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*Rules for rounding off numerical values ( *revised* ).

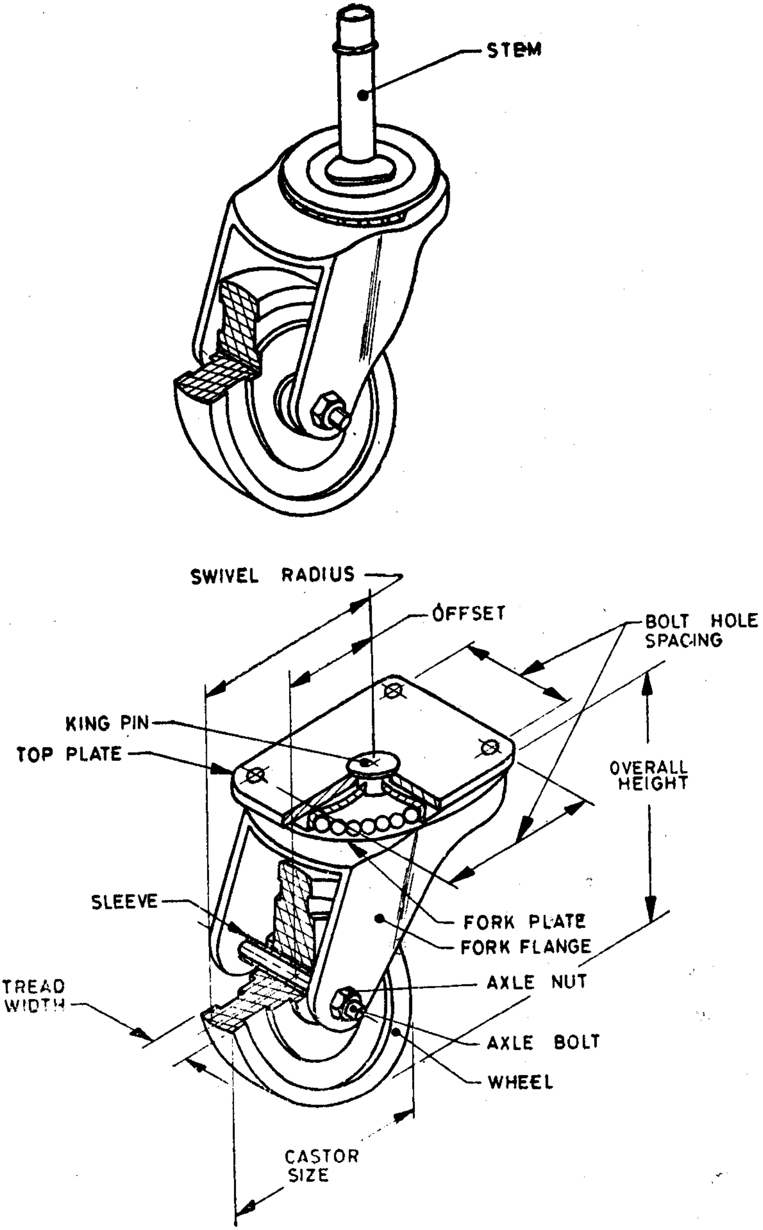


FIG. 1 NOMENCLATURE FOR CASTORS

**2.5 Maximum Load Capacity** — The load each castor can be expected to carry when moved on a smooth floor at speeds not exceeding 3·0 km/h.

NOTE — Uneven floors may derate the given load ratings to approximately 60 percent.

**2.6 Offset ( or Lead )** — The horizontal distance between the centre line of the swivel bearing and the axle of a castor as mounted for normal use.

**2.7 Size** — Nominal diameter of the wheel.

**2.8 Stem** — The portion of the castor assembly that extends upwards into the equipment.

**2.9 Swivel Radius** — Horizontal distance between the centre line of swivel bearing and the most distance point on the wheel tread. It is also considered to be the radial clearance that permits the castor to swivel 360° without obstruction.

**2.10 Test Load** — The load each castor is required to carry when complying with each test procedure.

**2.11 Top Plate** — A horizontal plate which provides for attaching castor to the equipment by means of bolts.

**2.12 Tread Width** — The width of tread or tyre is the linear distance measured across the base of the tread ( not face ).

## 3. MATERIAL

**3.1 Castor** — Rubber shall be used for the manufacture of castor wheels. Other suitable materials may also be used if they meet the requirements of this standard.

**3.1.1** In case of anti-static castors, the rubber and other materials used for the wheels shall meet the requirements of anti-static properties as specified in **9.1** and **9.1.1**.

**3.2 Top Plate, Fork, Plug ( or Stem )** — These shall be of mild steel or suitable aluminium alloy and of such thickness and form that these will provide sufficient strength and rigidity to meet the requirements as specified in the standard.

**3.3** The material for axle, nut and other parts shall be mild steel.

## 4. IDENTIFICATION

**4.1** The standard type references shall be derived as follows:

Hospital Castor H; Normal Duty N; Light Duty L

Nominal Wheel Sizes: 50 × 20 × 6; 65 × 25 × 6; etc

Fitting: Expansile Plug XPG; Solid Plug PG; Spring Core SC; Screwed Plug SPG; Plate PT

Wheel tyre }
Tube bore } Description given by the manufacturer
Finish }

*Example*:

A castor of rubber wheel, normal duty, wheel size 50 × 20 × 6, solid plug fitting shall be designated as HN 50 × 20 × 6 PG, wheel tyre, tube bore, finish

## 5. DIMENSIONS

**5.1** The main dimensions of the castors shall be as given in Table 1.

**5.1.1 Light Duty Castors** — These shall conform to the dimensions given in Table 1 except that the maximum load capacity per castor shall be 25 percent of the loads shown, subject to a minimum of 6 kg.

## 6. CONSTRUCTION

**6.1 Wheels** — Wheels shall have (a) a soft-rubber tread securely vulcanized to a hard-rubber core or tread base, or (b) hard rubber or other suitable composition and be integrally moulded. The tread and core shall have compressive, flexural and impact strength adequate for the purpose intended and shall be resistant to the destructive action of water, mild acids and ordinary cleansing compounds.

**6.2 Fork** — The fork shall be well-formed and of such thickness that it will provide sufficient strength and rigidity.

**6.3 Axle** — The axle design and assembly shall be such that the axle will not revolve and the nut will not become loosened under normal working conditions. The method of assembly shall also prevent the clamping of the wheel between the flanges of fork when the nut on the axle bolt is drawn uptight. The end of the axle shall not project beyond the outside face of the nut or any other fixture for more than 6 mm and shall have a domed finish.

### 6.4 Bearings

**6.4.1** *Wheel Bearings* — When the wheels are provided with bush or ball bearing, the races shall be fully case hardened. For ball bearings, the races shall provide curvilinear contact with the balls and the inner races shall butt at a central point so as to provide the equivalent means of avoiding preloading and binding of the bearing members when the axle nut is drawn up tight. The inner races shall not revolve with the wheel.

6.4.2 *Swivel Bearings* — Castor swivel shall have ball bearings. In swivelling under load, all forces ( direct, component thrusts ) shall be effectively transmitted through the ball bearings in contact with the respective raceways. The races in swivel bearings shall provide curvilinear contact with balls. The races shall be fully case-hardened and these shall be either ground smooth or die-formed and coined.

6.4.3 *Balls* — The balls of wheel and swivel bearings shall be hardened to 700 to 800 *HV* and shall be ground and polished.

**6.5 King Pin in Swivel Bearings** — The king pin where used shall be of steel and be secured in place so that in swivelling, it shall not be in frictional contact with any member of the swivel bearing assembly. The king pin shall be of such a design, construction and material that it will maintain effectively the proper relative position of swivel bearing components for the life of the castor under normal working conditions.

6.6 The fit of the components to each other shall be such as to obviate wobble or rattle. Under no load the castor shall roll freely and the fork of swivel castors shall swivel freely.

6.7 There shall be adequate provision for the lubrication of the moving parts.

## 7. METHODS OF ATTACHMENT

7.1 The methods of attachment of the castors to the equipment shall be one of the following and shall be identified by the letter code shown against each attachment:

| *Attachment* | *Code* |
|---|---|
| Expansile plug fitting ( metal or rubber ) | XPG |
| Solid plug fitting | PG |
| Spring core fitting | SG |
| Screwed plug fitting | SPG |
| Plate fitting | PT |

### 7.2 Detailed Requirements of Fittings

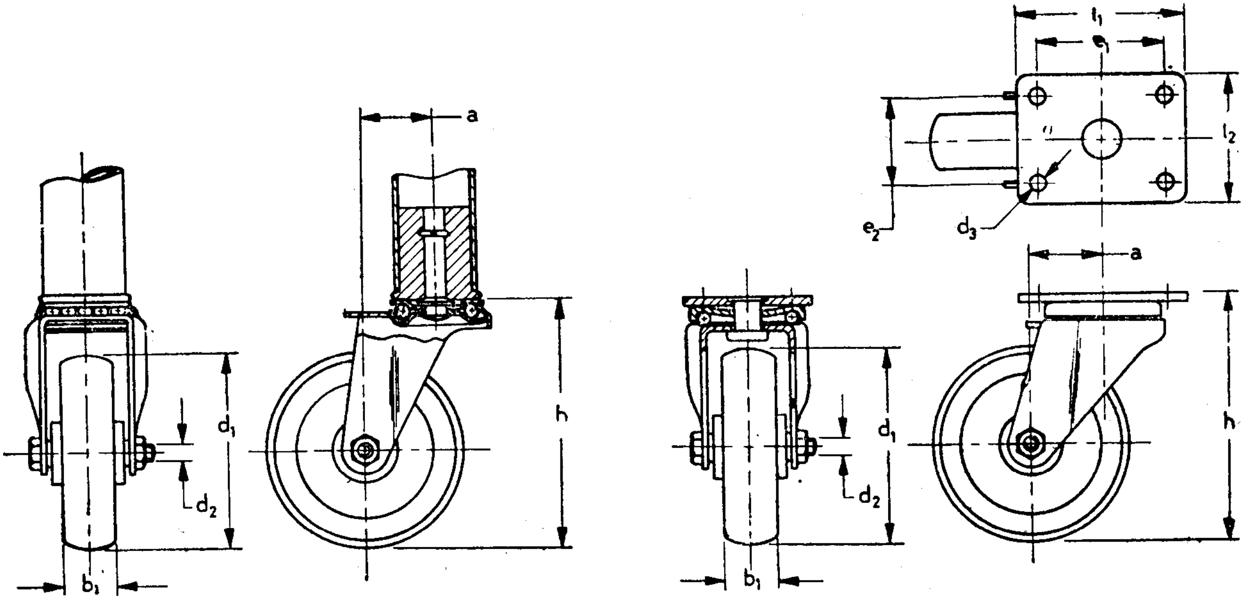
7.2.1 *Expansile Plug* ( *XPG* ) — Diameter of expansile plug shall be as specified according to internal diameter of tube, it is intended to fit and shall be capable of being tightened by hand or tool to resist a withdrawal pull of 20 kg for a period of one minute.

7.2.2 *Solid Plug fitting* ( *PG* ) — Diameter of the solid plug shall be as specified according to internal diameter of tube it is intended to fit. The

## TABLE 1 DIMENSIONS FOR CASTORS

( *Clauses* 5.1, 7.2.5, A-2.1, A-3.1, A-4.1 *and* B-2.1.2 )

All dimensions in millimetres.



| Identification | Nominal Wheel Size $d_1 \times b_1 \times d_2$ | Maximum Load Capacity per Castor kg | Overall or Effective Height (*h*) | Offset (*a*) | Plug ( or Stem ) Length *Min* |
|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) |
| HN 50 | 50 × 20 × 6 | 18 | 65 ± 1·5 | 15 ± 3 | 25 (20)* |
| HN 65 | 65 × 25 × 6 | 22 | 85 ± 2 | 25 ± 4 | 35 (20)* |
| HN 80 | 80 × 25 × 6 | 34 | 100 ± 2 | 35 ± 5 | 35 |
| HN 100 | 100 × 30 × 8 | 54 | 125 ± 3 | 40 ± 5 | 50 |
| HN 125 | 125 × 30 × 12 | 54 | 150 ± 3 | 45 ± 5 | 50 |
| HN 150 | 150 × 40 × 12 | 54 | 175 ± 5 | 50 ± 6 | 60 |
| HN 175 | 175 × 40 × 12 | 54 | 200 ± 5 | 60 ± 6 | 60 |
| HN 225 | 225 × 50 × 15 | 68 | 255 ± 5 | 70 ± 7 | 70 |

*For screwed plug fitting.

As in the Original Standard, this Page is Intentionally Left Blank plug shall be retained by a grease nipple or set screw of 5 mm up to and including 65 mm nominal diameter castors and 6 mm for 80 mm nominal diameter castors and above. An additional set screw shall be fitted to 'fixed' and brake castors.

**7.2.3** *Spring Core Fitting* ( *SC* ) — This shall consist of a stem having a suitable flange at its lower end to carry the load and a steel spring retainer shaped to fit tightly into the attachment when forced in. The core when properly applied shall withstand an extractive force of 4 kg for one minute. This shall be checked after the core has been inserted and pulled out 10 times.

**7.2.4** *Screwed Plug Fitting* ( *SPG* ) — This shall consist of a threaded stem and a nut securely fixed to the stem. The stem shall be at least of the length specified in Table 2 with threads up to 20 mm. This is recommended to be used up to 65 mm normal duty castors only and up to 100 mm light duty castors.

**7.2.5** *Plate Fitting* ( *PT* ) — Fixing centres and hole sizes shall be as given in Table 2 ( for Fig. *see* Table 1 ).

**TABLE 2 FIXING CENTRE AND HOLE SIZES**

( *Clauses* 7.2.4 *and* 7.2.5 )

All dimensions in millimetres.

| IDENTIFICATION | WHEEL SIZE $d_1 \times b_1 \times d_2$ | DIA OF HOLE* ($d_3$) | FIXING CENTRES $e_1 \times e_2$ | MOUNTING PLATE $l_1$ Nominal | MOUNTING PLATE $l_2$ Nominal |
|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) |
| HN 50 | 50 × 20 × 6 | 6 | 60 × 40 | 80 ± 2 | 60 ± 2 |
| HN 65 | 65 × 25 × 6 | 6 | 60 × 40 | 80 ± 2 | 60 ± 2 |
| HN 80 | 80 × 25 × 6 | 8 | 80 × 60 | 105 ± 3 | 85 ± 2 |
| HN 100 | 100 × 30 × 8 | 8 | 80 × 60 | 105 ± 3 | 85 ± 2 |
| HN 125 | 125 × 30 × 12 | 10 | 105 × 75 | 135 ± 3 | 105 ± 3 |
| HN 150 | 150 × 40 × 12 | 10 | 105 × 75 | 135 ± 3 | 105 ± 3 |
| HN 175 | 175 × 40 × 12 | 10 | 105 × 75 | 135 ± 3 | 105 ± 3 |
| HN 225 | 225 × 50 × 15 | 16 | 150 × 135 | 190 ± 3 | 170 ± 3 |

*With a tolerance of ± 0·5.

## 8. FINISH

**8.1** All mild steel parts shall be painted to shades white, off white or sea green as required by the purchaser. However, prior to painting these shall be degreased, rust-proofed by phosphating and then suitably protected by an anti-corrosive primer, either by brushing or by spraying and then finished in stove enamel or air drying enamel of the specified shade. In every instance each coat shall be separately stoved or air dried as the case may be. The resulting finish in either case shall be hard and shall not readily chip or flake. Alternatively the mild steel parts shall be chromium plated over nickel or cadmium plated or zinc plated. The chromium and nickel plating shall be according to Service Grade No. 3 of IS : 1068-1968*.

## 9. PERFORMANCE

**9.1 Durability** — The assembled castors shall be tested for their durability in accordance with Appendix A. These shall meet all the requirements of the test and still be capable of useful service. Anti-static castors shall meet in addition, the requirements of Appendix B.

**9.1.1** The test for anti-static features shall be carried out separately from and before the test for durability, as the severity of the latter test may produce temporary conditions in the tyre material which could give misleading results in the former test. The limits of resistance of anti-static castors shall be as stated in Appendix B.

## 10. MARKING

**10.1** The castors shall be clearly and indelibly marked with the manufacturer's name, initials or recognized trade-mark.

**10.1.1** *Anti-static Castors* — When castors are required to be anti-static they shall be conspicuously and indelibly marked to indicate that they are anti-static. The marking shall be as follows:

a) The exposed part of the wheel centres shall be durably finished in yellow similar to No. 355 Lemon as shown in IS : 5-1961†.

b) The tyres shall be marked with an indelible indication not less than 16·0 mm$^2$ in area in yellow similar to No. 355 Lemon as shown in IS : 5-1961† and not less than 6 mm wide the words 'ANTI-STATIC' where practicable incorporated thereon.

**10.1.2** The castors may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspestion, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

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*Specification for electroplated coatings of nickel and chromium on iron and steel (*first revision*).

†Specification for colours for ready mixed paints (*second revision*).

## 11. PACKING

**11.1** The castors shall be packed according to their sizes. Each box shall carry a label indicating the identification of the castors ( *see* **4.1** ) with the manufacturer's name, initial or trade-mark. In addition, label shall carry the word 'ANTI-STATIC' in case of anti-static tyres.

# APPENDIX A

( *Clause* 9.1 )

## TEST FOR PERFORMANCE

## A-1. TEST CONDITIONS

**A-1.1** Each castor submitted for test shall perform all the test programme as detailed in **A-2** to **A-5** consecutively and in that order.

**A-1.2** For each part of the test, the castor shall be mounted in its normal vertical operating position on a clean, smooth, level and rigid surface, and the relevant test load shall be applied continuously at the point where the castor should normally accept the weight of the equipment it is designed to carry. All tests shall be conducted at room temperature and running tests shall be conducted at speeds not exceeding 3·0 km/h. Other test conditions shall be graduated according to wheel diameter as detailed in Table 3. Light duty castors shall be subjected to similar tests and conditions, at 25 percent of the stated loads, with a minimum set at 6 kg.

**TABLE 3 TEST DATA FOR HOSPITAL CASTORS**

( *Clauses* 9.1, A-1.2, A-2.1, A-3.1, A-4.1, A-4.1.1, A-6.1, A-6.3 *and* A-6.4 )

| Sl No. | Test Data | Nominal Diameter of Wheel, mm | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | HN 50 | HN 65 | HN 80 | HN 100 | HN 125 | HN 150 | HN 175 | HN 225 |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| | *Loads (kg)* | | | | | | | | |
| i) | Static test | 54 | 66 | 102 | 162 | 162 | 162 | 162 | 204 |
| ii) | Smooth running test | 18 | 22 | 34 | 54 | 54 | 54 | 54 | 68 |
| iii) | Hazards running test | 11 | 19 | 22 | 38 | 38 | 38 | 38 | 50 |
| | *Time ( hours )* | | | | | | | | |
| iv) | Static test | 1·0 | 1·0 | 1·0 | 1·0 | 1·0 | 1·0 | 1·0 | 1·0 |
| v) | Smooth running | 0·5 | 0·5 | 0·75 | 1·0 | 1·0 | 1·0 | 1·0 | 1·0 |
| vi) | Hazards running test | 1·5 | 2·0 | 2·25 | 3·0 | 4·0 | 4·0 | 4·0 | 4·0 |
| vii) | Wheel rock, mm | 0·5 | 0·5 | 0·5 | 1·0 | 1·0 | 1·0 | 1·0 | 1·0 |
| viii) | Swivel rock, mm | 0·75 | 0·75 | 0·75 | 1·0 | 1·25 | 1·4 | 1·8 | 2·3 |
| | *Hazards* | | | | | | | | |
| ix) | Height of drop, mm | 10 | 10 | 10 | 10 | 16 | 16 | 16 | 16 |

## A-2. STATIC TEST

**A-2.1** The castor shall be mounted on the surface plate and a test load applied for one hour continuously. The actual static test load for each size of castor is given in Table 3 (the test load is equal to 3 times the maximum load capacity as given in Table 1).

## A-3. SMOOTH RUNNING TEST

**A-3.1** The castor shall be mounted on the surface plate and the test load applied. The test load for each size of castor shall be as given in Table 3 (the test load is exactly equal to the maximum load capacity as given in Table 1). The loaded castor shall be run for a total period of time as given for the relevant wheel diameter in Table 3.

## A-4. HAZARDS RUNNING TEST

**A-4.1** The castor shall be mounted on the surface plate and the test load applied. The test load for each size of castor shall be as given in Table 3, and shall be not less than 60 percent of the maximum load capacity as given in Table 1. The loaded castor shall be run for a total period of time as given for the relevant wheel diameter in Table 3.

**A-4.1.1** *Hazards* — During the hazards running test, the castor shall negotiate, at least once in every 3 m of travel, a hazard, as shown in Fig. 2 with a vertical drop to the dimensions as given for the relevant wheel diameter in Table 3.

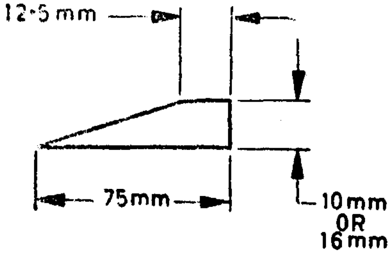


FIG. 2 HAZARD

## A-5. SWIVEL TEST

**A-5.1** During the whole of the smooth running test and the hazards running test as detailed in **A-3** and **A-4**, all castors of a swivel type shall be made to swivel, whilst running and under the appropriate load, through 180° at least once within a maximum of every 6 m travelled.

## A-6. TEST REQUIREMENTS

**A-6.1** The quality of the assembled castors shall be such that if tested in accordance with **A-1** to **A-5**, at the appropriate loads and for the periods stated in Table 3, they shall be still capable of useful service. Their ability to meet this requirement shall be assessed by a close examination of tested castors for the following indications of breakdown.

**A-6.2 Tyres** — The quality of the tyres shall be such that they shall show no substantial flattening of the wheel if subjected to the static load test ( **A-2** ). Any deformation that may exist after this test shall entirely disappear after running the castor for 10 minutes in similar conditions to those for the smooth running test ( **A-3** ).

**A-6.2.1** On the completion of the tests as detailed in **A-2** to **A-5** the tyres shall show uniform and regular wear, without cracks, flats or grooves.

**A-6.3 Wheels** — The wheel centre and the spindle shall be free from cracks; any wear in the bearing at the end of the test programme shall be such that the total amount of rock on the axle, measured on the periphery of the tyre shall not exceed the limits as given in Table 3.

**A-6.3.1** The measurement of wheel rock shall be made as indicated by letter ' A ' in Fig. 3.

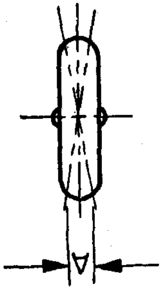


FIG. 3 WHEEL ROCK

**A-6.4 Swivels** — Any wear in the swivel bearing at the end of the test programme shall be such that the total amount of movement at the centre of the wheel axle shall not exceed the limits given in Table 3. The measurement of swivel rock shall be made as indicated by letter ' Z ' in Fig. 4, and shall be taken when the castor mounting is rightly held.

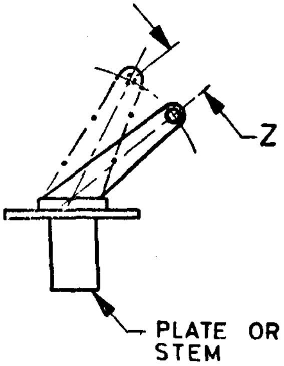


FIG. 4 SWIVEL ROCK

## A-7. ADJUSTMENT

**A-7.1** Castors which are so designed as to allow for adjustment to take up any wheel or swivel rock shall not be so adjusted after the test before examination.

# APPENDIX B

( *Clauses* 9.1 *and* 9.1.1 )

## METHOD OF TESTING ELECTRICAL RESISTANCE OF CASTORS

## B-1. METHOD

**B-1.1** The tyre should be cleaned by rubbing with a dry fullers earth using clean pad of cotton wool, care being taken to avoid straining the tyre materials.

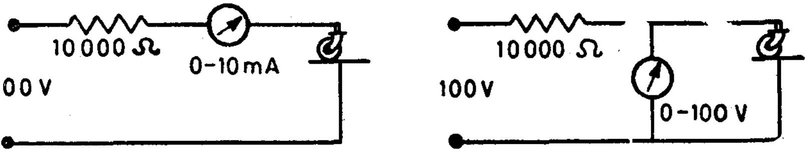
**B-1.1.1** After all traces of the powder have been cleared away, the surface shall be wiped over with a pad moistened with distilled water, and rubbed dry with a clean cloth.

## B-2. TESTING PROCEDURE

**B-2.1** The test circuit should not be capable of dissipating more than 2 W into the test sample.

**B-2.1.1** The applied voltage shall maintain a potential difference of at least 40 V across a test load of 10 000 ohms.

**B-2.1.2** The tyres shall be kept in contact with an insulated wet metal plate by means of a pressure between 5 and 10 percent of the rated load appropriate to the castor ( *see* Table 1 ). The test voltage shall be applied between the insulated plate and the appliance contact points on the castor and the resistance through the castor determined by measuring either the current or the voltage across it by either of the test circuits shown in Fig. 5.



5A Meter reading between 5 and 10 mA indicates sample resistance less than 10 000 Ω

5B Meter 10 000 Ω/V Meter reading below 50 V indicates sample resistance less than 10 000 Ω

FIG. 5 TEST CIRCUITS

## B-3. TEST RESULTS

**B-3.1** Tests shall be made on at least five different points around the circumference of the wheel and the results for new castors shall always be less than 10 000 ohms, any castor failing to meet this requirement shall be rejected.

NOTE 1 — Most insulation testors are unsuitable for testing castors having upper resistance limit of 10 000 ohms because of the very small deflection of the pointer at low resistance values.

NOTE 2 — Most multi-range resistance meters employ very low test voltages and are liable to give inconsistent measurements.

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